

# **The Honor Society of Agriculture Gamma Sigma Delta**

University of Arkansas Chapter

63<sup>rd</sup> Annual

Initiation and Awards Presentation,  
Guest Speaker and Student Competition

April 21, 2017, Pauline Whitaker Arena, Fayetteville, AR

## **Undergraduate Posters**

Title: *The Impact of a Science Field Camp Experience on Students' Learning of Environmental Concepts*

Authors: Madison Brown, Dr. Lisa Wood, Dr. Cathy Wissehr, Dr. Mary Savin

Abstract: Environmental education has garnered progressively more attention in years as global concerns of climate issues and conservation become increasingly prevalent. Educating young students is essential to developing a generation of stewards that are knowledgeable of their environmental impact and motivated to incite positive change in their surroundings. Using a mixed-methods study, a quantitative and qualitative analysis was conducted to evaluate the residential program at the Ozark Natural Science Center. Students attending the program were given pre-and post-assessments that evaluated their knowledge of a specific concept discussed at the residential program. In addition, parent and teacher chaperones were interviewed to assess the perceived objectives and impacts as well as the efficacy of the residential program in educating students in matters of environmental science and conservation. Assessments were "scored" based on their accuracy in addressing questions and demonstrating knowledge of environmental concepts. Interviews were transcribed and recorded. Evaluation of the post assessments demonstrated a statistically significant decrease in overall scores, however, a significantly positive increase was recorded in the scores pertaining to water quality and benthic macroinvertebrates. The interviews established that the chaperones' main expectation for the residential program lie in promoting stewardship rather than educating for content. Additionally, chaperones believe the residential program is fully meeting their expectations. It is recommended that the wording of the assessments be re-evaluated to ensure clarity in prompts and that the method in which assessments are administered be made more uniform. A larger sample size for chaperone testimony is recommended and further research is encouraged.

## **M.S. Poster Competition**

### **1<sup>st</sup> Place**

Title: *The effect of sand topdressing on earthworm casting activity in warm-season golf course turfgrass*

Authors: Paige E. Boyle, Dr. Michael D. Richardson, Dr. Mary C. Savin, and Dr. Douglas E. Karcher

Abstract: As earthworms feed, they can egest aggregates (casts) on the soil surface. In low-cut turfgrass systems, surface casting can result in pest invasion, reduced aesthetics, decreased photosynthesis, and playability issues. Because pesticide use for earthworm control is illegal in the United States, earthworms must be managed through cultural practices such as sand topdressing, a practice commonly used on golf courses to even the playing surface and reduce organic matter buildup. Topdressing has been suggested as an earthworm control method with the goal of using abrasive sand particles to irritate the soft-bodied earthworm skin; however, results have been varied. The purpose of this study was to test the effect of heavy ( $2.54 \text{ cm yr}^{-1}$ ) or light ( $0.64 \text{ cm yr}^{-1}$ ) topdressing treatments on earthworm casting activity in bermudagrass

(*Cynodon* spp.) in both native silt-loam soil and sand-capped root zones. Weekly cast counts were conducted from November 2015 to July 2016. Preliminary results indicate that during fall and spring active seasons, casting rates can be up to 50% greater in sand root zones compared to soil root zones. Within the soil root zone, heavy topdressing resulted in a 10-fold increase in casting during the active seasons, while in the sand root zone, casting counts were similar between topdressing treatments. These results are counter to expectations, and soil properties and earthworm identification are being investigated to gain more insight into the results. The results of this study can assist superintendents when planning for legal earthworm control on their golf courses.

## **2<sup>nd</sup> Place**

Title: *Evaluation of Topramezone-Containing Tank-mixes in Rice for Barnyardgrass Control*

Authors: M.H. Moore, R.C. Scott, and J.K. Norsworthy

Abstract: Every growing season, rice (*Oryza sativa*) producers struggle to control herbicide-resistant weeds. Barnyardgrass (*Echinochloa crus-galli*) is especially difficult to control due to its competitiveness and tendency to evolve herbicide resistance. Biotypes of barnyardgrass in Arkansas rice are known to be resistant to at least five herbicide sites of action. Therefore, new herbicides are needed to slow the advancement of this resistant weed. Topramezone, an alternative site of action, is currently used in corn (*Zea mays*) for control of broadleaves and some annual grasses including barnyardgrass. A field experiment was conducted in 2016 to evaluate the efficacy of topramezone, formulated as Armezon<sup>®</sup> 2.8L, when applied alone and in combination with other common rice herbicides. Treatments were arranged in a randomized complete block design as a two-factor factorial. Factor A included six rice herbicides (clomazone, imazethapyr, fenoxaprop, propanil, quinclorac, and saflufencil) applied at their respective labeled rates. Factor B consisted of three rates of topramezone (0, 12, and 24 g ai ha<sup>-1</sup>). All treatments were applied at the 3- to 4-leaf growth stage. A significant increase in barnyardgrass control was observed when topramezone (24 g ha<sup>-1</sup>) was tank mixed with clomazone (97%) as opposed to topramezone (79%) or clomazone (52%) alone. However, some tank-mixes significantly reduced control with topramezone applied alone, such as saflufenacil (65%). This research indicates that it is possible to effectively control barnyardgrass with topramezone-containing tank-mixes, but some may reduce control.

## **3<sup>rd</sup> Place**

Title: *Individuals who more often consume rice can better detect variations in sensory characteristics with serving temperature*

Authors: Ragita Pramudya and Han-Seok Seo

Abstract: Rice is an integral part of the everyday diet in numerous cultures. However, eating manner and cooking condition vary considerably with cultural background. While in many countries cooked rice is often consumed at high temperatures (e.g. 60 to 70 °C), it is also consumed at or below room temperature as side dishes or in lunch boxes in some Asian countries. Serving temperature has been found to affect sensory perception and preference of

food items. The present study aimed to determine whether and how sensory characteristics of cooked rice are perceived as a function of serving temperature. Two brands of long grain rice were cooked and presented with temperatures of 30, 40, 50, 60, and 70 °C to 88 participants with mean age of 36.6 (Standard Deviation = 14.4). Participants evaluated rice sensory characteristics using the Check-All-That-Apply (CATA) methodology. Results showed that proportions of selected sensory characteristics, such as bitter taste, firmness, moistness of grains, were significantly affected by serving temperature ( $P < 0.05$ ). Additionally, the panelists' rice consumption frequency influenced the effect of serving temperature on rice sensory characteristics. More specifically, participants who frequently consumed rice (>3 times a week) could better distinguish the serving temperature-induced subtle differences in cooked rice than those who consumed less. In conclusion, this study displayed that serving temperatures and rice consumption frequency could influence cooked rice sensory perception. Findings of the present study would provide rice breeders, processors, and manufacturers more insight into the dynamics of sensory characteristics with serving temperature in cooked rice.

[The following abstracts are in no particular order]

Title: *Preemergence and Postemergence Control of PPO-resistant Palmer amaranth in LibertyLink soybean*

Authors: M. M. Houston\*, L.T. Barber, J. K. Norsworthy, J. S. Rose, H. D. Bowman

Abstract: In Arkansas, approximately 3 million acres of soybean are planted each year. Large portions of Arkansas production acreage have been infested with glyphosate-resistant Palmer amaranth, resulting in a heavily reliance on PPO (protoporphyrinogen oxidase) herbicides for preemergence (PRE) and residual postemergence (POST) control options. Subsequently, this reliance on the PPO chemistry resulted in the first PPO-resistant Palmer amaranth in Arkansas, which was collected in 2011. Research was conducted in 2016 in Marion, Crawfordsville, and Gregory, AR with populations of PPO-resistant Palmer amaranth. The objective of this trial was to determine effectiveness of multiple PRE herbicide formulations followed by glufosinate plus fomesafen and metolachlor POST. Data derived from visual control ratings show PRE herbicide formulations that rely exclusively on PPO-inhibitors for suppression of Palmer amaranth have significantly reduced levels of control compared with PRE programs that include multiple effective herbicides. Herbicide formulations such as Boundary<sup>®</sup> (metribuzin + metolachlor) and Fierce XLT<sup>®</sup> (flumioxazin + pyroxasulfone + chlorimuron) provided over 80% control whereas treatments of flumioxazin, sulfentrazone, and metolachlor alone all provided 65% or less control of Palmer amaranth. Results showed the first POST application, which consisted of glufosinate in combination with fomesafen and metolachlor improved control ratings 5% for each treatment fourteen days after POST application. The second POST application, glufosinate alone, did not make a significant difference in control. Effective PRE herbicides followed by glufosinate with a residual POST provided excellent control when POST applications were made prior to Palmer amaranth reaching 4 inches in height.

Title: *Reducing Ultradwarf Bermudagrass Putting Green Winter Injury with Covers and Wetting Agents.*

Authors: E.J. DeBoer, M.D. Richardson, J.H. McCalla, and D.E. Karcher

Abstract: As ultradwarf bermudagrass (*Cynodon dactylon* x *C. transvaalensis*) putting green use in the United States moves further north, there is increased risk of sustaining winter injury from desiccation and low temperature exposure. Although protective covers are an essential tool for reducing winter injury of ultradwarf greens, installation and removal of these covers to allow for golf during favorable weather is costly and labor intensive. This research aims to define a predicted low temperature threshold when covering an ultradwarf green becomes necessary and to quantify the effects of a late-fall wetting agent application on winter survival. Research was conducted on replicated plots of ‘Champion’, ‘Mini-Verde’, and ‘Tifeagle’ bermudagrass. Covering treatments were placed at forecasted low temperature thresholds of -9.4, -7.8, -5.6 and -4.0 °C and were compared to an uncovered control. A single late-fall wetting agent application was applied as a split plot to each cultivar x cover treatment. Plots receiving cover treatments achieved significantly faster spring green-up than the uncovered control but were not significantly different from each other. ‘Mini-Verde’ and ‘Tifeagle’ achieved significantly faster spring green-up compared to ‘Champion’ but were not significantly different from each other. Plots receiving a wetting agent application achieved significantly faster spring green-up compared to the control. These data suggest the possibility of reducing the predicted low temperature threshold for covering greens without a significant increase in winter injury severity. This temperature reduction can reduce golf course labor costs and increase revenue with more days open for play.

Title: *Auxin Herbicides Applied Postemergence in Cotton Technologies.*

Authors: J.S. Rose\*, L.T. Barber, J.K. Norsworthy, and H.D. Bowman.

Abstract: Recently two new cotton technologies have been released to the market, Enlist cotton a 2,4-D-tolerant technology and Bollgard II XtendFlex cotton which provides tolerance to dicamba. However, up until recently, no herbicide label was issued for in-crop use of dicamba or 2,4-D in these crop technologies. Following the release of these new technologies, questions regarding whether or not they would also provide tolerance to other families of auxinic herbicides were raised. Tests were conducted in 2016 to determine whether or not new cotton technologies possess tolerance to other families of auxin herbicides following an over-the-top application. This experiment was conducted using Enlist, Bollgard II XtendFlex, and Glytol/LibertyLink cotton varieties and was arranged using a split-split-plot design. Treatments consisted of a single postemergence application at a 1x and 1/16x rate to 7-leaf cotton. Treatments were applied using a TTI 110015 nozzle at the rate of 12 gallons per acre with a tractor-mounted sprayer. Percent crop injury relative to the nontreated was recorded at 3, 7, 14, and 21 days after application (DAA) on a scale of 0-100, with 0 being no visible injury and 100 being complete plant death. At 21 DAA, aboveground biomass was collected from a 3.3 ft of row from each cultivar in each treatment, dried, and recorded as a percent of the corresponding nontreated check. The Enlist variety exhibited tolerance to a 1X rate of, 2,4-D, Starane Ultra, and

Grandstand whereas the other two varieties were sensitive to these herbicides. The Xtend technology only appeared tolerant to dicamba herbicide. The misuse of synthetic auxin herbicides on nontolerant cultivars could cause severe injury or plant death.

Title: *Assessment of Potential Inzen™ Grain Sorghum Herbicide Programs*

Authors: H.D. Bowman, T.Barber, J.K. Norsworthy, J.Rose, N.Steppig

Abstract: DuPont™ has recently announced the development of a new herbicide-resistant trait called Inzen™, which exhibits tolerance to acetolactate synthase (ALS)-inhibiting herbicides. Nicosulfuron has traditionally been used in corn production for control of annual and perennial weedy grass species, including difficult-to-control johnsongrass (*Sorghum halepense*) and will now be an available option for Inzen™ grain sorghum, labeled as Zest™. The potential for a new herbicide-resistant trait for grain sorghum has resulted in the need for research to determine best management practices. A field study was conducted in 2016 at the Arkansas Agricultural Research & Extension Center in Fayetteville, Arkansas to evaluate control of troublesome grass weeds, including johnsongrass in grain sorghum. Seventeen weed control programs were evaluated. Data were analyzed as a randomized complete block with four replications. When any preemergence herbicide application was followed by a postemergence herbicide application of Zest™ tank-mixed with atrazine, control of grass species was increased. Johnsongrass control was as high as 84% and Palmer amaranth controlled 95% when Dual Magnum was applied preemergence followed by Zest™ plus atrazine. All applications of Zest™ caused little to no injury to grain sorghum, illustrating that the Inzen™ trait will be a safe alternative for season-long grass control in grain sorghum.

Title: *Residual Activity of Thiencarbazone-Methyl Compared to Current Residual Herbicides in Soybean (Glycine max)?*

Authors: Z.D. Lancaster, J.K. Norsworthy, N.R. Steppig, M.H. Moore

Abstract: With the pressure that herbicide resistant weeds put on current residual herbicides, new options are needed to effectively rotate herbicide mode of action, and slow the development of additional herbicide resistance. Bayer is currently evaluating thiencarbazone-methyl (TCM), an ALS herbicide, which could provide activity on many troublesome midsouth weeds in soybean. A field experiment was conducted to determine the residual activity of TCM compared to several common residual herbicides. The experiment was set up as a two factor, randomized complete block design with factor-A being TCM rate applied and factor-B being tank-mix partner. TCM treatments evaluated were no TCM, 33.5 g ai ha<sup>-1</sup> TCM, and 67 g ha<sup>-1</sup> TCM. Tank-mix partners evaluated were labeled rates of Dual Magnum, Valor, Zidua, Tricor, and Balance Bean along with a no tank-mix partner treatment. Overall, TCM alone provided excellent control of broadleaf signalgrass (>94%) regardless of rate at 42 DAA. Control of the native ALS-resistant Palmer amaranth population was only 69% with 67 g ha<sup>-1</sup> of TCM at 42 DAA. However, the addition of 67 g ha<sup>-1</sup> of TCM to the labeled rate of Tricor resulted in a significant increase in Palmer amaranth control with 84% control from Tricor alone and 96% control from Tricor + 67

g ha<sup>-1</sup> TCM. Similar trends were observed for entireleaf morningglory. This research shows that TCM alone provides excellent residual weed control of broadleaf signalgrass and entireleaf morningglory, with some added Palmer amaranth control (48-69%). Furthermore, the addition of TCM improved performance of many common residual herbicides.

Title: *Effect of Shade Timing and Intensity on Creeping Bentgrass Influenced By Trinexapac-Ethyl and Plant Protectant*

Authors: Travis R. Russell, Douglas E. Karcher and Michael D. Richardson

Abstract: Turfgrass plant health and growth is limited by the availability of photosynthetically active radiation. The cumulative photosynthetically active radiation for one day is termed the daily light integral and has been demonstrated as an effective measurement for quantifying turfgrass light requirements. The effects of shade timing (morning versus afternoon irradiance) and shade intensity on creeping bentgrass turfgrass quality remain unclear. The interactions between shade timing, shade intensity, growth regulators demonstrated to increase shade tolerance such as trinexapac-ethyl, and plant protectants such as Turf Screen that promote the ability to increase photosynthetic efficiency need further investigating. The objective of this research is to determine the effects of shade intensity, timing, trinexapac-ethyl, and Turf Screen on creeping bentgrass putting greens and to determine the daily light integral requirement to maintain acceptable turfgrass quality. To simulate tree shade typically found on golf courses, four shade intensity treatments (0%, 70%, 80% and 90% reduction of full irradiance) were applied to the turf during morning hours (sunrise to solar noon) or afternoon hours (solar noon to sunset). Applications of trinexapac-ethyl or Turfscreen were made biweekly. Quantum light sensors measuring photosynthetically active radiation were used to determine daily light integrals for each treatment. Preliminary results indicate turfgrass quality significantly declined under all shade intensities regardless of timing. Turfgrass quality declined more rapidly as shade intensity increased in afternoon shade treatments compared to morning shade treatments. This observation may be explained by average daily light integrals of afternoon shade treatments being lower than morning shade treatments.

Title: *X-Ray Detection of Fissures in Rough Rice Kernels*

Authors: Z. Odek and T. J. Siebenmorgen

Abstract: X-ray imaging is a viable method of fissure detection in rough rice kernels owing to the ability of X-rays to penetrate hulls, thus allowing visualization of internal rice kernel structure. Current methods of fissure detection are only applicable for brown and milled rice, and therefore cannot be used to study fissures developed during rough rice drying. In this study, the fissure detection capability of an X-ray system was evaluated and the relationship between head rice yield (HRY), as measured through laboratory milling, and the percentage of fissured rough rice kernels was determined. Long-grain rice lots of various cultivars were dried using heated air at 60°C, 10% RH for five drying durations to produce different degrees of fissuring, and then milled to determine the HRY. A strong linear correlation ( $R^2 = 0.95$ ) between HRY and the

percentage of fissured rough rice kernels after drying was determined. This correlation confirms the substantial impact that kernel fissures have on milling yields. Overall, these findings show the effectiveness of X-ray imaging in rough rice fissure detection, which could allow for in-situ drying research that may provide a better understanding of kernel fissuring kinetics.

Title: *Influence of commercial yeast products in diets for beef cattle new to the feedlot environment*

Authors: E. A. Palmer, J. J. Ball, E. B. Kegley, P. A. Beck, J. G. Powell, J. A. Hornsby, J. L. Reynolds, and B. P. Shoulders

Abstract: Two truckloads of male beef calves ( $n = 172$ ; initial BW =  $226 \pm 24.5$  kg) were used to evaluate the effect of commercial yeast products on health and growth performance during a 28-d receiving period. Within truckload, calves were blocked by initial BW, stratified by gender, and assigned randomly to pen (5 or 6 calves/pen; 15 pens/truckload). Pens within each weight block were allocated to 1 of 3 treatments; an unsupplemented control, or supplementation with 2 commercial *Saccharomyces cerevisiae* yeast products (**Y1** or **Y2**). Each day, a mixture (0.14 kg/d for each calf) of 58% ground corn and 42% of the appropriate yeast product, or 100% ground corn (control) was added to the feedbunks immediately after basal diet delivery. Average daily gain from d 0 to 28 was not different ( $P = 0.99$ ) between groups. Supplementation did not affect DMI ( $P \geq 0.92$ ) or gain:feed ratio ( $P \geq 0.91$ ). Morbidity was observed daily at feeding. Percentage morbidity due to bovine respiratory disease (**BRD**) was not altered ( $P = 0.29$ ) with supplementation. Percentage of relapses were 32.7, 38.8, and 51.9 ( $P = 0.36$ ) for the control, Y1, and Y2, respectively. Days until first antibiotic treatment were not different ( $P = 0.17$ ) between the 3 treatments. Antibiotic treatments began on d 2 and by d 5 approximately 50% of calves had been administered their first antibiotic. In high risk calves with over 50% morbidity by d 5, providing yeast products did not have an effect on health and growth performance.

## Ph.D. Poster Competition

### 1<sup>st</sup> Place

Title: *Overcoming Antagonism in Tank Mixtures of Glufosinate + Glyphosate and Glufosinate + Clethodim on Grasses*

Authors: Chris J. Meyer<sup>1</sup>, Jason K. Norsworthy<sup>1</sup>, and Zack D. Lancaster<sup>1</sup>

Abstract: Proper management of glufosinate and the LibertyLink® and Glytol®/LibertyLink technology is needed to mitigate the likelihood of resistance evolution. An investigation into herbicide interactions that could occur in these technologies on grass weeds is needed. A field experiment was conducted in Fayetteville, AR in 2015 and 2016 that included three grass weed species: barnyardgrass, large crabgrass, and broadleaf signalgrass. The single factor (herbicide treatment) consisted of glufosinate, clethodim, and glyphosate alone and tank mixtures of glufosinate plus glyphosate or clethodim. Weed control and biomass data were collected 4 weeks after the herbicide application for each species and herbicide interactions were identified. When a low rate of glyphosate (867 g ae ha<sup>-1</sup>) was applied with glufosinate at 451 or 595 g ai ha<sup>-1</sup>, antagonism was identified for control of barnyardgrass. Increasing the rate of glyphosate to 1735 g ha<sup>-1</sup> in mixture with glufosinate at 867 g ha<sup>-1</sup> mitigated the antagonism for barnyardgrass control. Antagonism was present for all tank mixtures for control of large crabgrass. For broadleaf signalgrass control, antagonism was identified for two mixtures: glufosinate (451 g ha<sup>-1</sup>) + glyphosate 1735 g ha<sup>-1</sup> and glufosinate (535 g ha<sup>-1</sup>) + glyphosate 867 g ha<sup>-1</sup>. Therefore, to properly steward the LibertyLink and Glytol/LibertyLink technologies, the highest labeled rates of both herbicides should be used when tank-mixed to mitigate antagonism on a variety of grass weeds.

### 2<sup>nd</sup> Place

Title: *Association Analysis for Seed Height in Edamame*

Authors: David Moseley

Abstract: Increasing the seed size in soybean seed is an important breeding objective in an edamame breeding program. The goal of this research was to identify SNP markers that are associated with seed height in edamame germplasm. 271 accessions, weighing  $\geq 28\text{g}/100$ , ordered from *Germplasm Resources Information Network* (GRIN), were used for the association analysis of seed height. 42,081 SNPs for each accession were downloaded from SOYBASE ([www.soybase.org](http://www.soybase.org)). Structure and Mega 7 software grouped the 271 accessions into two groups. The association analysis was estimated by Tassel and GAPIT software. 24 SNPs were found to be associated with seed height in edamame, with SNPS ss715633048 and ss715586799 to be highly associated.

## M.S. Oral Competition

### 1<sup>st</sup> Place

Title: *Barnyardgrass Control Using Acetochlor in Midsouth Rice*

Author: M.E. Fogleman, J.K. Norsworthy, and M.H. Moore;

Abstract: Rice producers in the Midsouth are limited in effective management strategies when targeting herbicide-resistant barnyardgrass (*Echinochloa crus-galli*). Heavy reliance on the same herbicide site of action results in a high risk for evolution of resistance in weed populations. However, effective herbicide chemistries may be preserved by targeting alternative sites of action. Acetochlor, a very long-chain fatty acid-inhibiting herbicide with excellent activity on annual grasses and low risk of resistance, has a potential fit in rice. In the summer of 2016, a field experiment was designed to evaluate the efficacy of acetochlor (Warrant) in a complete rice herbicide program. The study was designed as a randomized complete block with factors being 1) herbicide, 2) rate, and 3) timing. Delayed preemergence applications of acetochlor at 1,050 and 1,470 g ai ha<sup>-1</sup> or clomazone at 336 g ai ha<sup>-1</sup> were applied 1) alone, 2) followed by imazethapyr at 71 g ai ha<sup>-1</sup>, or 3) followed by imazethapyr early-postemergence followed by imazethapyr pre-flood (PREFLD). Two weeks after treatment, acetochlor provided 71% control of barnyardgrass at the high rate, while clomazone provided > 90% control. Six weeks after PREFLD application, programs using clomazone exceeded 98% control of barnyardgrass and programs containing acetochlor provided ≥ 96% control. Crop injury was ≤ 5% and yields ≥ 10,000 kg ha<sup>-1</sup> across all treatments, indicating that acetochlor as a component of a rice herbicide program may provide a high level of weed control that is comparable to programs used today.

### 2<sup>nd</sup> Place

Title: *Rice Microbial Community Responses To Drying By Industrial Microwave*

Author: Deandrae L. Smith, Griffiths G. Atungulu, Stephen Rogers

Abstract: The typical convective heated air-drying methods for rice are not metered to inactivate harmful fungal spores that produce mycotoxins. Some mycotoxins such as aflatoxin are highly toxic and present health hazards to grain consumers. The objective of this study was to investigate the effectiveness of utilizing microwaves (MW) at 915 MHz frequency to achieve rapid decontamination, especially of aflatoxigenic fungal spores. Medium-grain rough rice (cv. CL721) at initial moisture content (MC) of 23% (w.b.) was dried using a 915 MHz industrial MW set to transmit energy at power levels 5, 10, and 15 kW for 4, 6, and 8 minutes and for rice bed thicknesses 5, 10 and 15 cm. Inactivation of the aflatoxigenic fungal spore (*Aspergillus flavus*) and other bacteria across the bed thickness was studied. At the highest specific energy (900 kJ/kg-rough rice), which corresponded to setting processing conditions to 15 kW power level and 6 minute heating duration for a 10 cm thick rice bed, the reduction of aflatoxigenic fungal and anaerobic bacterial loads were 2.75 log CFU/g-rough rice and 3.00 log CFU/g, respectively. Microbial loads were significantly reduced (p<.05) by increasing specific energy input. Disparity of microbial inactivation across the entire rice bed was negligible (for rice bed thicknesses up to 15 cm). This work showed that MW drying of rough rice holds promise as a

rapid drying method with potential benefits of microbial decontamination; this may help producers combat fungi related problems such as those resulting from mycotoxin contamination.

### **3<sup>rd</sup> Place**

Title: *Occurrence of Protoporphyrinogen Oxidase-Resistant Palmer amaranth in Arkansas*

Author: Hannah E. Wright, J.K. Green, G.T. Jones, V. Varanasi, C. Brabham, and J.K. Norsworthy

Abstract: Palmer amaranth (*Amaranthus palmeri*) is one of the most troublesome weeds in Arkansas row crop production, with documented resistance to four modes of action. Resistance of several Palmer amaranth accessions to protoporphyrinogen oxidase (PPO-inhibiting herbicides) was recently documented in Arkansas. A greenhouse study was conducted using in 2016 (2015 collections) and 2017 (2016 collections) at the Arkansas Agricultural Research and Extension Center in Fayetteville, AR using geo-referenced Palmer amaranth accessions from suspected resistant fields throughout Arkansas. Accessions were seeded into two 50-cell trays containing potting mix so an exact number of plants could be sprayed and evaluated. Fomesafen (Flexstar), a commonly used PPO-inhibiting herbicide, was applied at a rate of 395 g ai ha<sup>-1</sup> at the 2- to 4-leaf stage. Live/dead counts were recorded 14 days after treatment and survival calculated as a percentage. A susceptible standard was used to confirm complete control at the labeled rate. Most of the survivors from accessions collected in 2016 were also evaluated for the G210 codon deletion. Based on survival of plants following treatment, there are likely multiple resistance mechanisms present in these accessions. Additionally, the presence of PPO resistance in Palmer amaranth appears to be greatest in northeast Arkansas, with few resistant accessions found south of I40. These findings are being communicated to growers in hopes that they will develop effective weed control programs for Palmer amaranth in the coming year.

*[Other participants – in no significant order]*

Title: *Response of non-Xtend soybean to low rates of dicamba and glyphosate applied during reproductive development*

Author: Priess GL, Jones GT, Norsworthy JK, Barber LT, and Fogleman ME

Abstract: The 2015 and 2016 launch of Monsanto's Xtend dicamba-resistant cotton and soybean, respectively, without a labeled dicamba product for use incrop led many grower to illegally spray the herbicide in Arkansas. It is believed that a federal label will eventually allow dicamba and glyphosate to be applied over-the-top of Xtend crops; however, it is unknown if a tank-mixture of the two herbicides will provide greater risk for injuring non-dicamba/glyphosate-resistant soybean versus drift rates of each herbicide alone. It is commonly understood that non-dicamba-resistant soybean is highly susceptible to dicamba injury at very low rates. The objective of this study is to evaluate the impact of drift rates of dicamba plus glyphosate when applied over the top of glufosinate-resistant soybean at different growth stages. These trials were placed at two locations: Arkansas Agricultural Research and Extension Center in Fayetteville, and Pine Tree Research Station near Colt. These trials were conducted in 2015 and 2016. When dicamba was applied alone, (29%) injury was recorded at 28 days after application. With the addition of

glyphosate plus dicamba, injury increased (35%) at 28 days after application on R1 soybean. Drift rates of glyphosate plus dicamba at R3 stage of soybean increased pod malformation at maturity (53%) versus dicamba alone (37%). The reason for greater injury when glyphosate is tank-mixed with dicamba is not well understood, and further <sup>14</sup>C-glyphosate and -dicamba work will be needed to understand if glyphosate aids in the translocation of dicamba.

Title: *Dicamba Dissipation Under Simulated Drift Conditions in Soybean Grown With Variable Water Amendments*

Author: Matthew N. Thompson, Cammy D. Willett, Jason K. Norsworthy

Abstract: With the anticipated use of dicamba increasing because of the planting of dicamba-resistant soybean (*Glycine max*) and cotton (*Gossypium hirsutum*), off-target movement of the herbicide in the form of physical drift and volatility is likely. Soybean provide around \$1.7 billion in annual revenue for Arkansas, and due to the extreme sensitivity of non-dicamba-resistant soybean to the herbicide, the potential for economic loss is high. This study was established to understand the impact of environmental conditions on visible injury and the dissipation of dicamba in soybean. Soybean were grown in a Leaf silt loam in a greenhouse environment. Sixty plants were kept under drought conditions, and sixty were kept near field capacity. Both populations were sprayed at the V1 growth stage with dicamba at 5.6 g ae ha<sup>-1</sup> (a 1/100<sup>th</sup> labeled rate of Engenia<sup>TM</sup>, BASF Corporation) to simulate a drift event. Four plants from each water treatment were isolated as controls and did not receive herbicide application. Injury was visually assessed 3, 7, 14, 21, and 28 days after treatment (DAT). Plant tissue and soil samples were collected concurrently with injury ratings, and included additional sample collection on 0, 1, and 2 DAT. Preliminary results indicate that the drought-stressed soybean display reduced dicamba injury compared to plants at field capacity, but also exhibit reduced overall growth. These findings suggest that environmental factors, such as soil moisture content, can influence the dissipation of dicamba in susceptible soybean varieties. This knowledge could assist economic loss predictions associated with drift injury caused by dicamba.

## **Ph.D. Oral Competition**

### **1<sup>st</sup> Place**

Title: *Could emotions be used as a tool to understand consumer liking and preferences toward beverages?*

Author: Shilpa S. Samant, Matt Chapko, and Han-Seok Seo

Abstract: Traditional methodology to measure liking and preferences toward food and beverages heavily depends on subjective responses of the consumer participants. Owing to limitations of subjective responses, more objective means are required to better predict consumer liking and behavior. Purpose of this study was to develop a new methodology to predict consumer liking and preference toward basic taste solutions based on emotional responses measured using facial expression analysis (FA), autonomic nervous system responses (heart rate, skin conductance,

skin temperature) (ANS), and EsSense25 questionnaire (Q). A total of 102 participants (51 females,  $39 \pm 14$  years) were asked to taste water, sucrose, citric acid, salt, and caffeine solutions. FA and ANS were measured immediately after consumption. Q responses, intensity perception, and overall liking ratings were also recorded. After a 10-min break, participants were asked to re-taste the samples and rank them according to their preference. It was found that that combination of FA, and Q along with intensity perception provided a slightly better prediction of overall liking ( $R^2 = 0.50$ ) and preference rank ( $R^2 = 0.10$ ) respectively, compared to models fitted with FA and Q separately. Predicted and actual values showed moderate to strong correlations for overall liking ( $r = 0.72$ ) and preference rank ( $\rho = 0.54$ ). ANS provided limited contribution in predicting consumer liking and preferences. In conclusion, combination of emotional responses, particularly self-rated (Q) and facial expressions (FA), can help predict consumer liking and preference. Our findings can be extrapolated to further understand consumer behavior toward commercial beverages.

## **2<sup>nd</sup> Place**

Title: *Evaluation of Irrigation Sensors for Lawn Turf and Potential Water Savings.*

Author: Daniel Sandor, Dr. Douglas Karcher, Dr. Michael Richardson

Abstract: Many homeowners with automated irrigation systems are unaware of how much water they actually apply during an irrigation event and therefore could be wasting water. Rain sensors (RS) communicate with the irrigation timer to bypass irrigation following significant rainfall. Soil moisture sensors (SMS) provide the timer a real-time estimate of volumetric water content in the turfgrass rootzone, allowing the timer to prevent unnecessary irrigation. Previous research has observed significant water savings using SMS and RS, with minimal to no decline in acceptable turfgrass quality (TQ). Greater savings have been observed using SMS over RS, but both have shown significant savings compared to irrigation timers with no sensor device. It remains unknown how existing RS and new residential SMS models would behave in a temperate climate with fine textured soils. The objectives of this study are: 1) to evaluate the influence of irrigation sensors on TQ, and 2) evaluate the irrigation sensors for potential water savings. This study is conducted on *Cynodon dactylon* (L.) with scheduled irrigation applying 1.3 cm water twice weekly. Five irrigation treatments consist of two SMS models, two RS models, and a control (no sensor utilized). Data over two years show significant monthly water savings using SMS and RS with greatest significant water savings observed among SMS. Acceptable TQ was observed among all treatments and no significant differences in TQ were observed. From these results, SMS may significantly reduce water usage and simultaneously provide acceptable TQ and potentially an immediate return on investment in one season alone.

## **3<sup>rd</sup> Place**

Title: *Using transcriptomics to understand Quinclorac Resistance in Multiple-Resistant Junglerice (*Echinochloa colona*) from Arkansas*

Author: Christopher Rouse and Dr. Nilda R. Burgos

Abstract: Non-target-site herbicide resistance in weedy species describes physiological processes that enhance herbicide detoxification, alter herbicide uptake and movement, or reduce harmful byproducts of herbicide action. These abiotic stress responses can result in resistance to herbicides from multiple herbicide modes of action. Herbicide resistant junglerice (*Echinochloa colona*) pose a significant threat to Arkansas rice production. In 2010, a population of junglerice (ECO-45) was screened for resistance to common rice and soybean herbicides. ECO-45 was classified as resistant to quinclorac (>32X), propanil (>7X), cyhalofop (>2X) and glufosinate (>2X). Due to the high resistance to quinclorac, a unique mode of action in grasses, this population was ideal for RNA sequencing to elucidate biological processes involved in herbicide resistance. RNA sequencing of seedlings of ECO-45 and a susceptible accession (ECO-SS), treated with labeled rates of the aforementioned herbicides was performed. RNA sequencing was conducted on an Illumina-Hiseq platform, using paired-end reads. The *de novo* transcriptome was assembled from 76,414 transcripts, representing 59,968 genes. Differential gene expression (DGE) and gene ontology analysis were performed. Constitutive gene expression of the nontreated ECO-45 and ECO-SS revealed a 2.78% increase in transcripts in the resistant population, with an 11-fold increase in GST enzymes with herbicide detoxifying properties. Cross response analysis of quinclorac treated comparisons and the response to the herbicide treatments in the resistant population, identified a ‘transferase’ gene and an AP1 like protein with significant increases in expression. These genes have been characterized in xenobiotic detoxification and may increase detoxification of quinclorac in ECO-45, validation is required. Transcriptomics is a new tool for herbicide resistance assessment with increasing value in describing whole-plant biological responses to herbicides in resistant weedy species.